A PHILOSOPHICAL DISCOURSE UPON EARTHQUAKES,

THEIR

CAUSES and CONSEQUENCES;

COMPREHENDING

An Explanation of the Nature of ſubterraneous Vapours, their amazing Force, and the Manner in which they operate; the Sentiments on this Head of the moſt learned Philoſophers ancient and modern; the different Kinds of EARTHQUAKES, diſtinguiſhed by their Effects; and a copious Collection of authentic Relations digeſted under thoſe Titles.

To which is prefixed,

A Preliminary Diſſertation,

In which is attempted a rational Explanation of the Riſe, Progreſs, and Extent of the late dreadful EARTHQUAKE, ſo ſenſibly felt through great Part of EUROPE, on *Saturday*, *November* 1, 1755.

By Wortley Montague Junr.

LONDON:
Printed for M. COOPER in Pater-noſter-Row. 1755.

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A
Preliminary Diſcourſe, &c.

THERE has not happened within the Memory of the preſent Age, any Event ſo wonderful in its Nature, or ſo terrifying in its Conſequences, as that wide-ſpread Earthquake, which after alarming many, and ſeverely afflicting ſome Places, has, at length, buried the Royal City of *Liſbon* in Ruins; and perhaps we have not yet received a compleat Relation of its Ravages, though the Accounts already handed to us are more than ſufficient to fill every well diſpoſed Mind with ſerious Concern. But in order to conceive truly of this Matter, and to fix our Senſe of Things on a ſolid Baſis, ſome Enquiries will be neceſſary, from which we may aſcertain in the firſt Place the vaſt and unuſual Extent of the late Earthquake, acquire in the next a competent Notion of that lamentable Calamity, which, from a very imperfect Repreſentation, we have ſo juſtly and generally regretted; and laſtly, take even this ſad Event as an Occaſion of enlarging our Ideas, and acquiring a truer Apprehenſion of theſe terrible Commotions than hitherto we have attained.

After conſidering as maturely as poſſible the Notices we have hitherto received, comparing them with each other, and having regard to the Difference of Longitude, we ſhall preſume to fix the Origin of this Phænomenon in the North. We know that the Waters were very ſtrongly affected at *Hamburgh* and *Lubec*, which muſt have been owing to the heaving of the Earth under the Sea; and it is only from repeated and violent Motions of this kind, that the Accidents publiſhed by the News-Papers as happening in thoſe Places, can be tolerably explained. It is indeed true, that as yet we have no Matter of Fact on which to ground our Opinion, and therefore we muſt have recourſe to Conjecture, which will have this Advantage, that Time will infallibly ſhew whether it is well or ill founded.

The foreign Gazettes informed us not long ago, that the laſt Summer was unuſually hot in *Groenland*, by which we mean that large Country in which the *Danes* have a Colony, and not *Spitzbergen*, which is alſo called *Greenland*; that vaſt quantities of Ice and Snow, which had lain, ſo far as the Inhabitants knew, for Ages on the Mountains, were diſſolved, and that this had produced prodigious Quantities of Graſs in all the Vallies, and flat Country. As it is very well known, that the great Principle of Fertility in thoſe northern Regions, is the vaſt Quantity of Sulphur lodged in the Bowels of the Earth; it ſeems therefore highly probable, that by the ſoaking in of ſuch exceſſive Floods of a nitrous Fluid upon theſe Beds of Sulphur, a prodigious Fermentation might enſue, and the Vapours kindling at a great Depth in the Bowels of the Earth, proceed with ſuch Violence as to heave up that Part of the Sea under which they paſſed. This will very well account for all that fell out in the Places beforementioned, tho' we ſhould ſuppoſe, and indeed there is reaſon for it, that the principal Efforts of theſe ſubterraneous Vapours were made at a conſiderable Diſtance from the *German* Shore. It is likely that they paſſed more immediately under the Sea that lies between *Great Britain* and *Ireland*, which occaſioned thoſe uncommon Appearances in *Loch-Lomond* in *North-Britain*, a ſmart Shock in *Cumberland*, a ſurprizing Return of the Tide in the Harbour of *Cork*, and an Earthquake in the City on *Saturday* the 1ſt of *November* about thirty-ſix minutes after nine in the Morning. It was felt longer, and with a much greater Variety of Circumſtances, at *Kinſale*; the Cauſes of which, ſo far as we can judge, muſt have been, partly from an Exploſion of the ſubterraneous Vapour there, and partly from the violent Repercuſſion of the Water from the oppoſite Coaſt of *Great-Britain*. That Swell of the Ocean, which, as we before obſerved, occaſioned ſuch ſtrange Appearances at *Hamburgh*, *Lubec*, and other Places adjacent, muſt likewiſe have excited that extraordinary Agitation which was felt in the Port of *Amſterdam*, at *Leyden*, *Gouda*, *Rotterdam*, and many other Places in *Holland*, as alſo at *Portſmouth*, in all which Places it ſeemed only to affect the Water. But the main Stream of theſe ſubterraneous Vapours ſeems to have paſſed directly on to the Mouth of the *Garonne*, where having ſhaken *Bourdeaux* extremely, and ſeveral other Places thereabouts, it proceeded to the Coaſts of *Spain*, and ſeems to have forced a Paſſage under the very Heart of that Kingdom, as appears by theſe Vapours having ſhaken *Bilboa*, *Madrid*, the *Eſcurial*, and, for any thing we know, Places on the *Mediterranean*; at leaſt, this is highly probable, ſince we find the Force of this Commotion was felt at *Milan*, and at ſeveral other Places in *Italy*, more eſpecially at *Venice*.

But if the vaſt incumbent Weight of Earth prevented the Earthquake from making any great Devaſtation in paſſing under that extenſive Kingdom, it's Fury appeared the greater, by meeting with leſs Reſiſtance upon the Coaſt. At the Mouth of the River *Tagus* ſtands the little Town of *Caſcaes*, which received ſome Hurt. A little higher up, that is, on the North Side of the *Tagus*, ſtands the Fort, the Monaſtery and Palace of *Belem*, where the King of *Portugal* was with all the Royal Family at the Time of this diſmal Event; and the Shock was ſo ſtrong there, that his Majeſty abandoned his Palace in great Haſte, and remained without Guards, and almoſt without Suſtenance for twenty-four Hours, leſs affected with his own Diſtreſs, than with the diſmal Spectacle of the Subverſion of his Capital, which happened immediately under his Eyes.

The City of *Liſbon* was conſpicuous in almoſt all the Lights that can render a Place remarkable and reſpected. On the Banks of a large and beautiful River, at the Diſtance only of two Leagues from the Ocean, and having a fair, ſafe, and capacious Port, it was become, after *London* and *Amſterdam*, the third great Emporium of *Europe*. It was the principal Seat of Juſtice, in which the ſupreme Tribunals of *Portugal* were fixed; it was an Archiepiſcopal and Patriarchal See, producing a Revenue of forty-thouſand Ducats. As the Prelate appeared with the Splendour almoſt of a Pope, ſo his Chapter, by a ſpecial Privilege, procured by the late King, reſembled nearly in all Reſpects the College of Cardinals, and was but very lately filled up, and the Members confirmed in all their Dignities and Revenues by his preſent moſt Faithful Majeſty. This City was alſo the Seat of the Inquiſition, that Tribunal terrible in all places, but moſt terrible here. Add to all this, that it was likewiſe the Royal City, the Reſidence of Don *Joſeph* I. of the Houſe of *Bragança* King of *Portugal*, and the Capital of that flouriſhing and opulent Kingdom. But, as the Subject ſeems to require it, we will endeavour to be a little more particular.

This City is ſo ancient, that we may fairly ſay we know nothing with any tolerable Certainty as to its Foundation. Before the *Romans* beſtowed upon it the Name of *Felicitas Julia*, it was called *Uliſipo*, from whence in all probability proceeded the Fable of its being built by *Ulyſſes*, of which there is not the ſmalleſt Probalility. The beſt Judges of theſe matters, think it was raiſed by the *Phænicians*,

Phænicians, and ſtiled in their Language, *Alis Ubbo*, or, the *Delightful Bay*. In a long Tract of Years it grew to what it was. It ſtood upon ſeven Hills, was divided into forty Pariſhes, each of which had a handſome Church. There were in it beſides, twenty Convents and eighteen Nunneries; the Number of Houſes between thirty and forty thouſand, containing three hundred thouſand Inhabitants at leaſt, (which is almoſt a third part of the Inhabitants of *Portugal*) it was ſix Miles in Length, and fourteen in Circumference, ſurrounded by an old Mooriſh Wall flanked with ſeventy-ſeven Towers, with twenty-two Gates towards the River, and ſixteen towards the Land.

In Point of Climate it was remarkably happy; ſo temperate, that Roſes and many other Flowers blow there even in Winter; ſo wholeſome, that People live to an extraordinary Age, and in a manner free from Infirmities. For this Reaſon it was the Aſylum of ſuch as ſuffered by the Decays of declining Nature, or were emaciated, or wore out by Diſeaſes, and who for theſe Reaſons reſorted thither from all parts of *Europe*. Few Cities were better ſupplied with Water, or with Proviſions; none exhibited a more ſtately Appearance at a Diſtance, none commanded a more noble Proſpect from within. In this *Liſbon* was a kind of Type of the Grandeur of this World: for notwithſtanding the Appearance, and the Proſpect, there was, excepting a few grand Squares, nothing that could be called noble, and ſcarce any thing that with Propriety could be ſtiled Convenience, much leſs Elegance, in the Place. The very Structure of the City upon Eminencies and Declivities expoſed it to a variety of difficult and diſagreeable Paſſages, narrow and obſcure Streets, winding and ſteep Lanes ſcarce paſſable for Carriages, while the Lazineſs and Inattention of the Natives ſuffered ſuch Accumulations of Filth, as rendered it naſty and ſtinking, and conſequently nauſeous in ſpite of the faireſt Climate, and fineſt Situation in the World.

It was however the Commerce and the Wealth of *Liſbon* that in the preſent Age was eſteemed its higheſt Prerogative. A Port beautiful beyond Deſcription, not more beautiful than ſafe, and not more remarkable for Safety than for its Capacity, was the Source of the one, as that was of the other. It was the Center of the Trade of *Portugal*, and of a great Part of *Spain*, the River *Tagus* being navigable as high as *Toledo*, ſo that here were the general Magazines of all the Commodities, and of the few Manufactures of the Kingdom. Beſides this, all the Ships that *Portugal* employs in what ſtill remains to her of the Commerce of the *Indies*, and of *Guinea*, came hither; and here alſo centered the rich Trade of the *Brazils*, from whence they received commonly three Fleets in a Year. It was this that drew ſo vaſt a Reſort of *Engliſh*, *French*, *Dutch*, *Hamburghers*, *Daniſh*, and *Swediſh* Ships, and made it one of the moſt ſtirring and plentiful Marts in *Europe*. On the River-Side lay that magnificent and ſpacious Area, called, the Square of the Palace, having the royal Reſidence, one of the fineſt, and the moſt regular in the World on one ſide, and a moſt noble Cuſtom-houſe on the other. Beyond this in another capacious Square, was the great Market with prodigious Magazines of Corn, and near it along the Kays, the Houſes and Warehouſes of thoſe who dealt in that and other bulky Commodities. All theſe Parts are ſaid to have been deſtroyed on the firſt inſtant, between nine and ten o' Clock, but the Time not hitherto well aſcertained, by a Shock that laſted five Minutes. The Ravages in the upper Part of the City are aſcribed, partly to the Earthquakes, and partly to the Fires that followed them, and according to the haſty Accounts we have received, reduced the greateſt Part into Rubbiſh, with the Deſtruction of one fourth of its Inhabitants. An Event equally dreadful and deplorable, and yet not altogether unforeſeen, ſince beſides its being ſhaken by former Earthquakes, particularly that in 1531, its Situation on ſo large a River, the *Tagus* being there three Miles broad, and in a manner ſurrounded with Mountains, juſtly expoſed it to the continual Fear of what has now happened.

Setubal, or St. *Ubes*, a famous Mart, and much reſorted to for Salt, which lies behind the Cape that forms the ſouth Entrance of the *Tagus*, is ſaid to be deſtroyed. Several very ſevere Shocks were felt in the *Algarves* at the Extremity of *Portugal*. It is not certain whether it was felt in the Fortreſs of *Gibraltar*, but it was very perceptible in the *Spaniſh* Camp which is very near it. We have very large and particular Accounts of the Miſchief done at *Cadiz*, and the Deſtruction of a great Part of that ancient and beautiful Cauſeway, by which this great trading City is connected to the Iſland of *Leon*, which is again connected to the Continent of *Spain* by a *Roman* Bridge. The Agitation and Swell of the Sea was prodigious through the whole Bay of *Cadiz*, and this about ten o' Clock. It was felt by Capt. *Clark* about the ſame Time in the Latitude of 36 Degrees 24 Minutes, in his Paſſage from *Denia* in the Kingdom of *Valencia*, and it was likewiſe felt with great Violence at St. *Lucar*.

From the Conſideration of theſe Particulars, one cannot help thinking, that a Diſtinction ought to be made between the extraordinary Swell and Agitation of the Waters, and the more immediate Effects of the Paſſage of the ſubterraneous Vapours which produced the Earthquake. Both were the Effects of the ſame Cauſe, but they ſeem to have been very different Effects, and perhaps cannot be with more Probability explained than by the Manner in which we have already endeavoured to account for them. For if we ſuppoſe the ſubterraneous Vapour taking Fire in *Greenland*, and proceeding almoſt in a direct Line under the Earth to the Continent of *Spain*, and in a Manner through that whole Kingdom, it will enable us to comprehend the different Effects, at the different Periods of Time, of which we have Accounts in theſe ſeparate Relations. For in paſſing under the Sea without Exploſion, they cauſed thoſe prodigious Swells which were felt on almoſt all the Coaſts of *Europe* at different Periods of Time, many of them later than the Shock at *Madrid*, or the ſtill greater Effect at *Liſbon*, where it ſhould ſeem that both the Effects met; the Vapours in their Paſſage, producing the Earthquake, and the Swell from the Ocean raiſing the Waters of the River *Tagus* in ſo extraordinary manner, as to be felt even as high as *Toledo*.

The following Diſſertation, which it is hoped gives a tolerable Idea of the general Cauſe, and Conſequence of theſe Commotions in the Bowels of the Earth, was written and publiſhed on the two Earthquakes felt in *London* on the 8th of *February*, and on the 8th of *March*, 1750; and the Letter annexed was publiſhed in the general Evening Poſt, containing ſome very curious Queſtions in Reſpect to theſe Phænomena which tho' they deſerve to be ſeriouſly conſidered and explained, have not hitherto been anſwered. Some have imagined that this late Earthquake did not paſs to, but from, the Coaſts of *Spain*, to theſe Northern Parts; and it was this that occaſioned the haſty Publication of theſe Thoughts which maintain an Opinion directly contrary, that coming out before either Sentiment can be eſtabliſhed from matters of fact, the Publick may have an Opportunity of diſtinguiſhing which is the beſt founded, from the ſubſequent Lights, which no doubt they will receive on this extraordinary and important Subject.

A
DISSERTATION.
UPON
Earthquakes, *&c.*

IT is a thing obvious enough to ſuch as have ſtrictly conſidered human Nature, that all the inferior Faculties of the Mind are entirely ſubſervient to that Kind of ruling Paſſion in the Soul, which as much diſtinguiſhes the Intellects of Men as their Faces are diſtinguiſhed by the Difference of Features. We have a pregnant Inſtance of this in that Inclination of hearing new Things, which is what we term CURIOSITY.

In a Mind, the true Character of which is Narrowneſs of Comprehenſion and Timidity, *Curioſity* is a low and creeping Quality, which exerciſes itſelf only in mean and dirty Enquiries; ſuch as Tricks and Artifices in Trade, Quirks in Law, Noſtrums in Phyſick, and Jobbs in Government. In a Mind ſomething better conſtituted, and where the Paſſions are of a warmer Complexion, Curioſity wanders after brighter Objects; ſuch as fine Sights, great Aſſemblies, or pompous Ceremonies. This Diſpoſition, as it is influenced by Circumſtances, carries a Man to Maſquerades in the Winter, Horſe-

Races in the Summer, to *Weſtminſter* at the Cloſe of a Seſſions of Parliament, when King, Lords, and Commons may be ſeen at one View, or to the Jubilee at *Rome* ; where, for the Sake of gratifying ſuch Tempers, and for the Emolument of a People, who have ſcarce any thing elſe to ſubſiſt on, a continued Series of fine Sights is contrived for a whole Year together.

In Minds of a ſuperior Order Curioſity ſoars ſtill higher, and diſdaining alike the deſpicable Enquiries of the firſt, and the flaſhy and fooliſh Humour of the latter ſort of People, it elevates itſelf into vaſt and noble Speculations, examines the whole Superficies of the Earth, or pierces through its inmoſt Receſſes to the very Center, examines the great Ocean, explores the Connection of particular Seas, viſits the ſecret Conveyances of Water, and traces its wonderful Circulation to the very Tops of the higheſt Mountains, where breaking out into perpetual Springs, it ſwells by continual Acceſſions into great Rivers, and then rolls down again into that vaſt Abyſs, which, as it is conſidered in theſe different Lights, may be eſteemed both Beginning and End : Or, riſing beyond the Limits of this little Globe, to which the Soul, while in the Body, is confined, it aſpires to an Acquaintance with other Worlds, and expatiates through the Univerſe, delighted with thoſe Diſcoveries here, the perfect Knowledge of which, will, in all Probability, be a Part of that Happineſs reſerved for rational Beings hereafter.

But as all things in this World are ſubject to numberleſs Viciſſitudes, ſo from time to time it happens, that Events, either extraordinary in themſelves, or which appear ſo from the Circumſtances that attend them, affect almoſt all Ranks and Degrees of People, and as it were abſorb the general

Curioſity. A pregnant Proof of which we have in the two late Shocks of an Earthquake, which being in our own Times ſo rare in this Country, tho' not ſo formerly, has attracted univerſal notice, and become, not the common only, but almoſt the ſingle Topick of Diſcourſe.

Yet, as it may be preſumed, that in a little time the Impreſſion even of theſe Accidents may wear off, and Mankind in general return from this conſtrained Meditations on Earthquakes, to the Purſuit of the ſeveral Objects which commonly entertain their reſpective Curioſities; it ſeemed no unfavourable Opportunity of offering to the publick View, in as tolerable a degree of Order, as ſo ſudden an Occaſion would admit, the Thoughts of ſome ſuperior Genii on ſo ſurprizing and important a Subject, and which Experience has convinced us, is not entirely foreign to the Age or Iſland in which we live.

As to the Antiquity of theſe wonderful Commotions, it has been the Opinion of ſome very learned, and, which is more to the Purpoſe, very wiſe Men, that as they are often the Cauſes of Deſtruction and Confuſion, ſo in the Hands of the omnipotent Creator, they might be the original Cauſe of the whole habitable World itſelf. The firſt Perſon who publiſhed this Notion, at leaſt as far as my Knowledge reaches, was our Countryman, the ſagacious Mr. *Thomas Lydyat*, in his *Philoſophical Diſquiſition, concerning the Origin of Fountains*, wherein, having mentioned the raiſing up Mountains in the Sea, by ſubterraneous Fires, he proceeds thus: "After which Manner alſo, all
" the Mountains in the World, together with the
" Continents themſelves (which are nothing but
" great Mountains or Iſlands ſcattered in the Ocean)
" in the Beginning of the World, when the Fire

" of which we ſpeak was firſt kindled in the Bowels " of the Earth by the Almighty Creator, were (as " it is moſt highly probable) originally raiſed up; " the Sea receding into the Cavities and depreſſed " Places, and, by the moſt wiſe Counſel of the " ſupreme Deity, leaving Room for terreſtrial " Animals to inhabit."

This Sentiment was adopted by Dr. *Simon Patrick*, Biſhop of *Ely*, in his Commentary upon *Geneſis*, where, ſpeaking of the Waters being gathered together, he ſays we may conceive this to have been done by ſuch Particles of Fire as were left in the Bowels of the Earth; whereby ſuch nitroſulphureous Vapours were kindled, as made an Earthquake, which both lifted up the Earth, and made Receptacles for the Water to run into. That learned Prelate thinks this in ſome meaſure proved by a Paſſage in the Pſalms, where, as ſoon as it is ſaid, *that the Waters ſtood above the Mountains*, which ſeems to expreſs the Condition of this Globe at its firſt Creation, it is immediately added, *at thy Rebuke they fled, at the Voice of thy Thunder they haſted away.* Now we know that an Earthquake is a Kind of ſubterraneous Storm, or, as the *Indians* in *North America* very well expreſs it, an under-ground Thunder.

The *Roman* Poet *Ovid*, not more eſteem'd for the Vivacity of his Parts, and the Beauties of his Verſification, than for the Extenſiveneſs of his Learning, in the fifteenth Book of his *Metamorphoſes*, deſcribes the Method in which a high Hill was elevated in a large Plain, by the Force of ſubterraneous Fire. This Account of his will at once illuſtrate the Matter, and convey the eaſieſt and cleareſt Conceptions of the Manner in which this ſtrange Birth of Nature was produced. Let us then liſten to his Song.

A Hill by Pitthœan Trœzan *Mounts uncrown'd*
With Sylvan Shades, which once was level Ground,
For furious Winds (a Story to admire)
Pent in blind Caverns ſtruggling to expire;
And vainly ſeeking to enjoy th' Extent
Of freer Air, the Priſon wanting Vent,
Puffs up the hollow Earth extended ſo,
As when with ſwelling Breath we Bladders blow:
The Tumour of the Place remained ſtill,
In Time grown ſolid, like a lofty Hill.

That ingenious Naturaliſt Mr. *John Ray*, took a great deal of Pains to eſtabliſh the Truth, or at leaſt the Probability of this Doctrine. He gives us a parallel Inſtance to that beforementioned, of a much later Date, in a Hill not far from *Puzzuolo*, in the Neighbourhood of the Gulph of *Baiæ*; which, ſays he, I myſelf have viewed and been upon. It is by the Natives called *Monti di Cenere*, and was raiſed by an Earthquake, *September* the Twenty-ninth 1558, of about One hundred foot perpendicular Altitude, though ſome make it much higher. According to *Stephanius Pighius*, it is a Mile aſcent to the top, and four Miles round at the foot; we indeed judged it not near ſo great. The People ſay it bears nothing; nothing of any Uſe or Profit, I ſuppoſe they mean: Otherwiſe I am ſure there grow Heath, Myrtle, Maſtick-tree, and other Shrubs upon it. It is a ſpongy kind of Earth, and makes a great Sound under a Man's Feet that ſtamps upon it. The ſame Earthquake threw out ſo much Earth, Stones and Aſhes, as quite filled up the *Lacus Lucrinus*, ſo that there is nothing left of it now, but a fenny Meadow.

When we ſay that this Mountain was raiſed by an Earthquake, we do not mean that the meer

Succuſſion, or ſhaking of the Earth, raiſed up the Mountain, but that the ſame Cauſe which ſhook the Earth, that is, ſubterraneous Fire, caſt up the Materials which raiſed the Mountain, and of which it doth conſiſt; that is, Stones, Cinders, Earth, and Aſhes. Indeed, under the Word Earthquake, in this Senſe, we comprehend the Concomitants and Conſequences of an Earthquake, and the efficient Cauſe of it, which is a ſubterraneous Fire.

Neither by the Elevation of Mountains do we mean, that they were all heaved up, as it were by a *Flatus*; but only ſuch where the incloſed Fire was not of Force ſufficient to make its way out, or found not *Spiracula* to vent itſelf. In other places where it was ſtrong enough to rend the ſuperincumbent Maſs of Earth, or found ſome Rifts or *Spiracula* to break out by; there, it iſſued with great Force, and threw up abundance of Stones, Aſhes and Earth, and ſo raiſed up a Mountain. If ſuch Hills, I ſay, as theſe may be, and have been elevated by ſubterraneous Wild-fire, *Flatus*, or Earthquakes, *ſi parvis liceat componere magna*, if we may compare great Things with ſmall, why might not the greateſt and higheſt Mountains in the World, be raiſed in the like manner, by a ſubterraneous *Flatus* or Wild-fire, of Quantity and Force ſufficient to work ſuch an Effect; that is, that bears as great a Proportion to the ſuperincumbent Weight and Bulk to be elevated, as thoſe under theſe ſmaller Hills did to theirs?

But we cannot doubt this may be done, when we are well aſſured that the like hath been done. For the greateſt and higheſt Ridge of Mountains in the World, the *Andes* of *Peru*, have been for ſome hundreds of Leagues in length, violently ſhaken, and many Alterations made therein, by an Earthquake that happened in the Year 1646; mentioned ed by *Kircher* in his *Arca Noæ*, from the Letters of the Jeſuits. And *Pliny* tells us, of his own Knowledge, that the *Alps* and *Appennine* have often been ſhaken with Earthquakes.

The ſame great Author aſſures us, that the Iſland *Hiera* near *Italy*, in the time of the Social War, together with the Sea itſelf, did burn for ſeveral Days; and *Strabo*, in the firſt Book of his Geography, reports, that about *Methone* in the Bay of *Hermione*, there was Earth raiſed, and, as it were, blown up, to the height of ſeven Furlongs, by a fiery Breath or Exhalation, which by Day-time was unacceſſible, by reaſon of Heat and ſulphurous Stench, but ſmelling ſweet by Night, and ſhining ſo as to be ſeen afar off; likewiſe caſting ſuch a Heat, as to cauſe the Sea to boil for five Furlongs, and to render it troubled for the ſpace of twenty Days, raiſing up therein a Bank of Stones as big as a Tower.

Theſe Inſtances I alledge, principally, becauſe they ſeem to demonſtrate a Poſſibility of the Accenſion of Fire in the Earth, when it is wholly covered with Water, and had no Intercourſe or Communication with the ſuperior or external Air, which is the main and moſt material Objection againſt the Elevation of the dry Land at the beginning, by ſubterraneous Fires.

Some will ſay, if the Mountains be thus heaved, or caſt up by ſubterraneous Fires, the Earth muſt be hollow all underneath them, and there muſt be vaſt Dens and Caverns diſperſed throughout them. To which we may anſwer, that it is true indeed, ſo there are; as may undeniably be proved by Inſtances. For Inſtance, ſince the new Mountain we mentioned at *Pozzuoli* was thus raiſed, being of a Mile ſteep aſcent, and four Miles round at the Foot, a protionable Cavity muſt be left in the Earth underneath:

neath: And Mount *Ætna*, at one of its laſt Eructations alone, having diſgorged out of its Bowels ſo great a Flood of melted Materials, as if ſpread at the Depth and Breadth of three Feet, might reach four Times round the whole Circuit of the terraqueous Globe; there muſt likewiſe an anſwerable Vault be left within.

If it be demanded, How then it comes to paſs, that they ſtand ſo firm, and do not founder and fall in, after ſo many Ages? We anſwer, that they may ſtand, as appears by the aforeſaid new-raiſed Mountain. For notwithſtanding the Cavity under it, it hath ſtood firm, without the leaſt ſinking or ſubſidency, for above two hundred Years, neither is there any great ſinking or falling in, at *Ætna* itſelf; at leaſt in no Degree anſwerable to its ejected Matter. This Aſſertion is confirmed by the unanimous Teſtimony of all Writers, ancient and modern, who have handled this Subject.

But *Alphonſo Borelli* ſuppoſes them not to have duly conſidered the Matter, or calculated the Quantity of the ejected Materials, and the Bulk of the Mountain, and compared them together, but to have been carried away by the Prejudices and Perſuaſion of the People, who looking upon the Top of the Mountain at a Diſtance, think it but a ſmall Thing, in Compariſon of the ejected Sand and Aſhes, that covered whole Countries, and thoſe vaſt Rivers of liquid Stones and other Ingredients, that ran down ſo many Miles; whereas he, by a moderate Computation, found, that the Total of what the Mountain diſgorged at the laſt Eruption, amounted not to much more than the fourteen thouſandth Part of the Solidity of the whole Mountain. The Reaſon of all this is, that the Strength and Firmneſs of their Vaulture, proves in general ſufficient to ſupport the ſuperincumbent Weight.

And yet in ſome Places, there are ſinkings and fallings in, which afterwards become Valleys or Pools of Water.

But as for the Cavities that are lower than the Superficies of the Ocean, the Water, where it could inſinuate and make its Way, hath filled them up to that Height. We ſay, where it could make its Way; for that there are many empty Cavities, even under the Sea itſelf, appears by the ſhaking and heating too of the very Water of the Sea in ſome Places in which Earthquakes have been felt, and raiſing up the Borders or Skirts of it, ſo as to drive the Water a great Way back, and the raiſing up new Iſlands in the Middle of the Sea, as *Delos* and *Rhodes*, and *Anapæ*, and *Nea*, and *Alone*, and *Hiera*, and *Theru*, mentioned by *Pliny* and *Thia* in his own Time, and *Theraſia* in the *Ægean*, in *Seneca*'s Time, which was heaved up in the Sight of many Mariners, then preſent and looking on.

This Manner of Reaſoning, ſhews evidently, the vaſt Advantages that ariſe from the Study of natural Hiſtory; for let a Man's Underſtanding be ever ſo ſtrong, yet if he truſts to it entirely, and attempts to account for every Thing from the Sagacity of his own Conjectures, he will make but a poor Figure in the Opinion of ſuch, as by Reading and Experiments have acquired a Fund of real Knowledge. The Truth of this Obſervation, may be eaſily ſeen, by comparing the Philoſophy of *Hobbs*, which was entirely the Produce of thinking, with that of *Boyle*, which reſts upon the Baſis of Enquiry and Experiments. But this, however, hinders not our Reaſoning with the utmoſt Freedom, from Experiments duly made, or from Facts well proved; and therefore, having opened a Way by theſe, we will follow the Lights afforded us by the great Authors before mentioned, and more particularly the penetrating Dr. *Hooke*, in order to receive thorough Satisfaction, how theſe hidden Wonders are really wrought; for that the Sources of theſe Fermentations, Heavings and Exploſions, are in the Bowels of the Earth, the former Inſtances ſufficiently demonſtrate. Theſe Materials we conceive to be ſomewhat analogous to the Materials of Gunpowder, not that they muſt be neceſſarily the very ſame, either as to the Parts, or as to the Manner and Order of Compoſition, or as to the Way of Accenſion; for that, as much the ſame Effect may be produced by different Agents, ſo the Methods and Order of proceeding, may be altogether as differing: A clear Inſtance of this we may find in the Phænomena of Lightning, wherein we may obſerve, that the Effects are very like to the Effects of Gunpowder.

For we have firſt the Flaſh of Light, which is very ſudden, very bright, and of very ſhort Continuance; being almoſt momentaneous, at leaſt every ſingle Flaſh is ſo, tho' the kindling of ſeveral Parts at ſome Diſtance from one another, does ſometimes continue a Succeſſion. or longer Duration of the Light. Next we may obſerve, the Violence of the Report or Noiſe, which is likewiſe as momentaneous as the Fire if it be ſingle; but if there be many particular Flaſhes that contribute to this Effect, and thoſe made at ſeveral Diſtances, then the Duration of the Thunder heard, is longer than the Duration of the Flaſhes of Lightning, which proceeds, as we conceive, from two Cauſes: Firſt, thoſe Flaſhes that are farther diſtant, have their Thunder a longer Time in paſſing to the Ear, than thoſe which are nearer, by reaſon that tho' the Paſſage or Motion of Light be almoſt inſtantaneous, yet the Progreſſion or Motion of Sound is temporaneous, and requires a certain ſenſible Time to paſs a ſenſible Space, and the Times are proportionably longer, as the Spaces paſſed are greater. But a ſecond Cauſe of the Duration of Thunder, I conceive, proceeds from Echoes by which the Claps are rebounded both from Parts of the Earth, and likewiſe Parts of the Air, or from charged Clouds, of both which I am ſufficiently aſſured, as well by natural Reaſoning, as from ſenſible Obſervations; and I have obſerved much the ſame Effect produced by the echoeing and rebounding of the Sound of a Piece of Ordnance, from Places at ſeveral Diſtances, adapted for the Production of ſuch Repercuſſions.

But thirdly, we have alſo the Power and Violence of the Force of the Fire and Expanſion in firing ſeveral Things that are combuſtible, in ſuddenly melting of Metals and other Materials, which are difficult and ſlow enough otherwiſe to flow, in rending, tearing, throwing down and deſtroying whatever ſtands in its Way; and after all, that which cauſeth theſe and many other ſtrange Effects reſembling thoſe of Gunpowder, ſeems to be nothing but a Vapour or Steam, mixed with the Body of the Air, which is inkindled not by any actual Fire, but by a kind of Fermentation, or inward Working of the Vapour.

Again we find, that the *Pulvis Fulminans*, as it is called, which hath ſome of its Materials differing from thoſe of common Powder, as alſo *Aurum Fulminans*, more differing ſtill, as to its Materials, and as to its Way of kindling, have yet moſt of the ſame Effects with Gunpowder, both as to the flaſhing and thundering Noiſe, and as to the Force or Violence. So that as theſe are differing in many Particulars, and yet produce much the ſame Effects, it is probable, that what is the Cauſe of Earthquakes, and ſubterraneous Thundring, Lightning, and violent Expanſion, as I may ſo call thoſe Phænomena

obſervable

obſervable in theſe Criſes of Nature, may be in ſeveral Particulars differing from every one of theſe, both as to the Materials, and as to the Form and Manner of Accenſion, and yet as to the Effects they may be very ſimilar, or analogous at leaſt.

So that tho' poſſibly we cannot prove what the Materials are, yet the Effects ſpeak them to be ſomewhat comparable to thoſe of Gunpowder, or *Pulvis Fulminans*, *Aurum Fulminans*, or Lightning; which, tho' they ſeem very differing in many Particulars, yet when we come to view the Cauſe and Reaſons of thoſe Effects, it will be manifeſt, that it is but one Operation in Nature, and that which cauſes the Effect in one, cauſes the Effect in all the reſt; and the outward Appearances of the differing Materials, and the different Way of operating, are nothing but the Habits, Dreſſes, and Vizards of the Actors, and the differing Modes, by which they act their ſeveral Parts, which, when they have done, they are at an End, and have exerted their whole Power, there muſt be a new Set of Actors to do the ſame Thing again. The Oil of the Lamp will be turned all into Flame, but you muſt have freſh Oil, if you will have the Flame continued.

So when the Materials that make the ſubterraneous Flame or Fire, or Expanſion, let us call it by which Name we pleaſe, is conſumed, and converted to another Subſtance, not fit to produce any more the ſame Effect, the Concuſſion ceaſes; and if the Conflagration be ſo great as to conſume all the preſent Store, we might ſafely conclude, that Place would no more be troubled with ſuch Evils; but if there be ſtill combuſtible Materials, either already fit and prepared, but ſheltered from Accenſion, by other interpoſing incombuſtible Materials, or that there be other Parts not thoroughly ripe, and ſufficiently prepared for ſuch Accenſion, then a Concurrence of After-cauſes may repeat the ſame Effects, and this *toties quoties*, till all the Mine be exhauſted, which I look upon as a Thing not only poſſible, but probable, nay, neceſſary; for that we find it to be the general Method of Nature, which is always going forward, and continually making a Progreſs of changing all Things from the State which ſhe finds them in at the preſent; all Things as they proceed to their Perfection, ſo they proceed alſo to their Diſſolution and Corruption, as to their preceding Eſtate; and where Nature repeats the Proceſs, it is always on a new Individual.

Theſe Conſiderations may ſerve to give a fair and probable Account of the general Cauſes of Earthquakes, and theſe will appear ſtill the more credible, when Mention is made of an Experiment actually tried, in order to diſcover how far theſe Principles might be relied on. We are informed in the Hiſtory of the *French* Academy of Sciences for the Year 1700, that Mr. *Lemery* made a Paſte of equal Quantities of Sulphur pounded, and Filings of Iron mixed with Water, of which he put about Thirty Pounds into a Veſſel, and then buried the Veſſel about a Foot deep in the Earth. In the Space of eight or nine Hours the Earth began to ſwell, to heave up, and at laſt burſt, when a thick ſulphurous Vapour ruſhed out with great Violence, and at laſt flamed. We may add to this, that vaſt Quantities of Sulphur mixed with ſome Pieces of Metal, which, upon a cloſe Examination, have been found to be Iron, are diſperſed by the Eruptions of the burning Mountains *Veſuvius* and *Ætna*.

It is eaſy to collect from hence, that as there is hardly any Country in which theſe Minerals are not found, ſo there is hardly any Region of which we have diſtinct Accounts, where, at ſome Seaſon or other, Earthquakes have not happen'd, tho' at the ſame Time it muſt be allowed, and the ſame Method of Reaſoning will enable us to comprehend, that ſome Countries are alſo more ſubject to them than others. Hence therefore we may ſee the Folly of believing, that ſome Places are ſafer from theſe Calamities than others, and that we may retire to them for Shelter; when in Fact no Country is entirely free from them, and we may as well run to as from them. By the Will and by the Wiſdom alſo of the Omnipotent Creator, Things are ordered ſo; and it is Madneſs mixed with Impiety, to repine at this Diſpoſition, or to flatter ourſelves with the Thoughts of flying from thoſe Inconveniencies to which he has been pleaſed to leave expoſed this Globe, on which we dwell.

But not to inſiſt longer upon Generals, the Hiſtory of Earthquakes is indeed a very large and copious Subject, and might afford Matter for many Volumes; however, it is not perhaps impoſſible to repreſent within a narrow Compaſs, the capital Points of ſuch a Hiſtory, and to illuſtrate them with proper Inſtances, which is all that is propoſed in this little Work. That we may do this with more Eaſe to ourſelves, and to the Reader, we will, according to the Circumſtances attending them, diſtinguiſh Earthquakes into their different Kinds.

The *firſt* of theſe is, where the Earth lying level with the Sea, has been, by the Force of ſuch ſubterraneous Fermentations, as we have deſcribed, raiſed often many Feet, ſometimes ſeveral Fathoms above that Level. We have many Inſtances of this in our own Country, where the beſt Writers of natural Hiſtory tell us, that in the County of *Norfolk* near St. *Bennet*'s in the *Holm*, are perfect Cockles and Periwinkles, ſometimes digged up out of the

Earth, which makes ſome think it was formerly overflowed by the Sea. The fenny Grounds alſo of *Lincolnſhire* and *Cheſhire* ſeem to have proceeded from the riſing of the Ground; and thoſe in *Angleſey*, where lop'd trees are now dug up with the perfect Strokes of the Axe remaining on them, ſeem to have been firſt ſunk under Water, then over-turned and buried in their own Earth, and afterwards the whole Earth ſeems to have been raiſed again to its former height.

The *next* kind of Earthquake is, where the Bottom of the Sea, from the ſame Cauſes, is elevated to ſuch a Degree as to be raiſed above its Superficies, ſo as to become not only viſible but firm and dry Land. We have a notable Inſtance of this in the Iſland of St. *Michael*, one of the *Canaries*, related by the famous Jeſuit *Athanaſius Kircher*, which Relation of his brought within a reaſonable Compaſs, runs thus, "*June* 26th, 1638, the whole
" Iſland began to be ſhaken by Earthquakes for
" eight Days; ſo that the Inhabitants left Ci-
" ties, Caſtles, and Houſes, but eſpecially thoſe
" of a Place called *Vargen*, where the Motion was
" more violent; after which Earthquake this Pro-
" digy followed, at a Place of the Sea where Fiſher-
" men uſed to fiſh in Summer, becauſe of the great
" Abundance of Fiſh there caught, called *La Fa-*
" *mera*, about ſix Miles from *Pico Delle Cramerina*,
" upon the firſt *Sunday* in *July*, a ſubterraneous Fire
" burſt out, notwithſtanding the Weight and Depth
" of the Sea in that Place, which was one hundred
" and twenty feet, as the Fiſhermen had often be-
" fore that found by ſounding, which one would
" have thought ſufficient to have quenched the Fire.

" A ſubterraneous Fire, I ſay, broke out with
" a moſt inexpreſſible Violence, carrying up into
" the Clouds with it Water, Sand, Earth, Stones,

" and other vaſt Maſſes of different Bodies, which
" to the ſad Spectators at a Diſtance, appeared like
" Flocks of Wool or Cotton, and falling back up-
" on the Surface of the Water looked like Froth.
" The Scene of this Eruption was about as big as
" a ſpace of Land that might be ſown by two
" Buſhels of Grain. By great Providence the
" Wind blew from the Land; otherwiſe the whole
" Iſland would, in all Probability, have periſhed
" by the mercileſs Rage of theſe devouring Flames;
" ſuch vaſt Bulks of Stone were thrown up into
" the Air, about the height to all Appearance of
" three Pikes, that one would rather think them
" Mountains than Rocks; and what added farther
" to the Horror of this dreadful Sight was, that
" theſe Mountains returning again, often met with
" others aſcending, and were thereby daſh'd into
" a thouſand Pieces, ſeveral of which Pieces being
" afterwards taken up and bruiſed, eaſily turned
" into a black ſhining Sand.

" Out of the great Multitude and Variety of
" theſe vaſt ejected Bodies, and the immenſe Heaps
" of Rocks and Stones, after a while was formed
" a new Iſland out of the main Ocean, which at
" firſt was not above five Furlongs over; but very
" quickly, by daily Acceſſes of new Matter, it
" increaſed, after fourteen Days, to an Iſland of
" five Miles over. From this Eruption ſo great a
" Quantity of Fiſh was deſtroyed, and thrown up-
" on the next adjoining Iſland, that eight of the
" largeſt Indian Galleons would not have been ſuf-
" ficient to contain them, which the Inhabitants,
" fearing the Stink of them might create a Plague,
" collected and buried in deep Pits. The Stench
" of the Brimſtone was plainly ſmelled at twenty-
" four Miles diſtance."

The *third* Kind of Earthquakes is, where the Earth heaves up in a Plain, and by ſo heaving up produces a new Hill, greater or leſs, according to the Potency of that Cauſe from which this Tumification happens. We have already ſeen ſeveral Inſtances of this both ancient and modern, from the Poet *Ovid*, and our learned Divine Mr. *Ray* ; but perhaps it may not be amiſs to illuſtrate it yet a little further.

Our inquiſitive and judicious Countryman Dr. *Childrey* tells us, that in a Pariſh by the Sea-ſide, not far from *Axbridge* in *Somerſetſhire*, within theſe One hundred and fifty Years, a Parcel of Land ſwelled up like a Hill, but on a ſudden, clave, and fell down into the Earth, and in the Place of it remains a great Pool. Our *Engliſh* Chronicles ſay, at *Oxenhall* in the Biſhoprick of *Durham*, on *Chriſtmaſs* Day 1579, the Ground heaved up aloft like a Tower, and continued all that Day immoveable, till Evening, and then fell with a horrible Noiſe, ſinking into the Earth, and leaving three deep Pits, called *Hell Kettles*. *Varenius* tells us of a new Mountain likewiſe raiſed in *Java* in the Year 1588, with the like Effects of thoſe formerly mentioned of the new Mountain ; firſt ſhaking the Ground, then heaving and throwing up into the Air the upper Parts of the Earth, afterwards the Rock and inner Parts, then fiery Coals and Cinders, overwhelming the circumjacent Fields and Towns, and killing above ten thouſand Men, and burning what was not overwhelmed.

The Iſlands alſo of St. *Helena* and *Aſcenſion*, are diſcovered by the great plenty of Cinders, and the appearance of the Hills, to have formerly contained Vulcanoes, and probably were at firſt made by ſome ſubterraneous Eruption, as indeed moſt of thoſe Iſlands in the main Ocean, ſuch as the *Canaries*,

and

and the *Azores*, and the *Eaſt Indian*, and the *Caribbee* Iſlands, and divers others, ſeem to have been.

A Paſſage to make this Aſſertion ſomewhat more probable, we may meet with in *Linſchoten*'s Deſcription of the Iſland of *Tercera*, which, as *Purchas* has epitomized, I have here added. “ The Land is
“ very high, and, as it ſeems, hollow, for as they
“ paſs over any Hill of Stone, the Ground ſounds
“ under them, as if it were a Cellar. So that it
“ ſeems in ſeveral Places, as if there were Holes
“ under the Earth, from whence it is much ſubject
“ to Earthquakes; as all the other neighbouring
“ Iſlands are, and all have had Mines of Brimſtone;
“ ſo that in many Places of *Tercera* and St. *Michael*,
“ the Smoke and Savour of Brimſtone continues ſtill
“ to iſſue out of the Ground, and the Country round
“ about is all ſinged and burnt. There are likewiſe
“ ſeveral Places wherein there are Wells, the Water
“ whereof is naturally ſo hot, that it will boil an
“ Egg, as if it were over a Fire.”

The *fourth* Species of Earthquakes is, where the Parts of the Earth are raiſed by an Acceſſion of freſh Earth lifted up and laid upon it, of which kind Hiſtory affords an infinite Number of Examples, and that almoſt in every Country, and under very different Climates. We ſhall mention only a few. That learned Northern Writer *Olaus Wormius*, in his *Muſæum*, has an extraordinary Relation of this kind, wherein he gives an Account of an Earthquake in *Iceland*, which filled the Air with Duſt, Earth, and Cinders, and overwhelmed Towns, Fields, and even Ships, a good way diſtant on the Sea, and which ſent forth its Fumes with ſuch Violence and in ſuch exceeding plenty, as covered all the Decks and Sails of Ships lying on the Coaſt of *Norway*, tho' at ſome hundred Leagues diſtant.

Another Inſtance of the like kind, we ſhall take out of the Hiſtory of *Peru*, written by a Deſcendant from the old Imperial Family; but previous to this, it will be requiſite to let the Reader know, that we aſcribe all earthy Rains to this Cauſe, tho' they fall at a great Diſtance from the Place where the Eruption happens.

“ I might add, ſays the princely Author, to
“ theſe Earthquakes, what happened in the Year
“ 1600 at *Arequepa*, by the raining of Sand, as al-
“ ſo of Aſhes, during twenty Days, from a *Vul-*
“ *cano* breaking forth: The Aſhes falling in many
“ Places above a Yard thick, in ſome more than
“ two, and where leaſt, above a quarter of a Yard,
“ which buried the Corn-grounds of Maize and
“ Wheat; the Boughs of Trees were broken and
“ rendered fruitleſs, and the Cattle, great and ſmall,
“ dyed for want of Paſture. For the Sand which
“ rained, covered the Fields thirty Leagues one
“ way, and above forty Leagues another way;
“ round away *Arequepa* they found their Cattle
“ dead, by Five hundred together, in ſeveral Herds,
“ and whole Flocks of Sheep, and Herds of Goats
“ and Swine buried. Houſes fell with the Weight
“ of the Sand, others coſt much Induſtry to ſave
“ them; mighty Thunders and Lightnings were
“ heard and ſeen. Thirty Leagues round about
“ *Arequepa*, it was ſo dark whilſt thoſe Showers
“ laſted, that at Mid-day they burned Candles to
“ ſee to do Buſineſs.”

The *fifth* kind of Earthquakes is, where the Earth ſinks down, either from a Hill into a Valley, or where in Conſequence of an Earthquake, inſtead of firm Ground, there appears a Lake of ſalt Water; of this, many Inſtances have happened in our own Country. Dr. *Childrey*, whom we have mentioned before, affords us no leſs than three; the firſt fell out *Auguſt* the fourth 1585, after a very violent Storm of Thunder and Rain, at *Mottingham* in *Kent*, eight Miles from *London* ; the Ground ſuddenly began to ſink, and three great Elms growing upon it were carried ſo deep into the Earth, that no part of them could any more be ſeen. The Hole left, ſaith the Relation, is in Compaſs eight Yards about, and a Line of fifty Fathoms plummed into it, finds no Bottom.

The ſecond happened *December* the Eighteenth 1596, a Mile and a half from *Weſtream*, Southward, which is not many Miles from *Mottingham*, a part of an Hedge of Aſhes-trees, twelve Perches long, were ſunk ſix Foot and a half deep, the next Morning fifteen Foot more, the third Morning, eighty Foot more at leaſt, and ſo daily.

And preſently after he ſays, Moreover in one Part of the plain Field, there is a great Hole made by ſinking of the Earth, to the Depth of thirty Foot at leaſt, being in Breadth in ſome Places two Perches over, and in Length five or ſix Perches. There are ſundry other ſinkings in divers other Places ; one of ſixty Foot, another of forty-ſeven, and another of thirty-four Foot, by means of which Confuſion, it is come to paſs, that where the higheſt Hills were, there be the loweſt Dales, and the loweſt Dales are become the higheſt Grounds.

His third Inſtance is this, *July* the eighth 1657, about three of the Clock, in the Pariſh of *Bickly*, was heard a very great Noiſe like Thunder afar off, which was much wondered at, becauſe the Sky was clear, and no Appearance of a Cloud. Shortly after, ſaith the Author of this Relation, a Neighbour came to me, and told me I ſhould ſee a very ſtrange Thing, if I would go with him. So coming into a Field called the *Leyfield*, we found a very great Bank of Earth, which had many tall Oaks growing on it, quite ſunk into the Ground, Trees and all. At firſt we durſt not go near it, becauſe the Earth, for near twenty Yards about, was exceedingly rent, and ſeemed juſt ready to fall. But ſince that time, myſelf and ſome others have ventured to ſee the Bottom, I mean to go to the Brink, ſo as to diſcern the viſible Bottom, which is Water, and conceived to be about thirty Yards from us, under which is ſunk all the Earth about it, for ſixteen Yards round at leaſt, three tall Oaks, a very tall Awber, and certain other ſmall Trees, and not a Sprig of them to be ſeen above Water. Four or five Oaks more are expected to fall every Moment, and a great Quantity of Land is like to fall, indeed never ceaſing more or leſs, and when any conſiderable Clod falls, it is much like the Report of a Cannon. We can diſcern the Ground hollow, above the Water, a great Depth, but how far hollow, or how deep, is not to be found out by Man. Some of the Water, as I have been told, drawn out of this Pit by a Bucket, was found to be as ſalt as Sea-water, *&c.*

We may add to theſe, another Inſtance of the like Kind in *Wales*; for two Miles Eaſt from *Brecknock*, is a Meer called *Llinſavathan*, which, as the People dwelling there ſay, was once a City, but that the City was ſwallowed up by an Earthquake, and this Water or Lake ſucceeded in the Place. The Lake is encompaſſed with high ſteep Hills, is without any Inlet or Outlet, and yet ſeveral great Roads from different Parts of the Country adjacent, terminate there. All theſe are ſo many Circumſtances, which render this Account ſo much the more probable. " Near *Falkirk*, ſaith *Lithgow* the " *Scots* Traveller, remain the Ruins and Marks " of a Town, ſwallowed up into the Earth by an

" Earthquake, and the void Place is filled with " Water." We might with Eaſe collect from foreign Hiſtories a Multitude of Facts of the ſame Nature, but as many will neceſſarily occur to the learned Reader's Mind, it will be ſufficient to add the following Extract from a private Letter, dated from *Balaſora*, in the *Eaſt-Indies*, from Mr. *Powell* to his Father-in-law Mr. *Daniel*, on *London-Bridge*, *January* the 6th, 1665. " We have had ſeveral " Earthquakes unuſual here, which with hideous " Noiſes, have in ſeveral Places broke out, and " ſwallowed up Houſes and Towns. But about " ſeven Days Journey from *Ducca*, where were at " that Time three or four *Dutch*, they and the Na- " tives relate, that in the Market Place, the Earth " trembled about thirty-two Days and Nights " without Intermiſſion. At the latter End, in the " Market Place, the Ground turned round as Duſt " in a Whirlwind, and ſo continued ſeveral Days and " Nights and ſwallowed up ſeveral Men, who were " Spectators, who ſunk and twined round with the " Earth, as in a Quagmire. At laſt the Earth " worked and caſt up a great Fiſh, bigger than " hath been ſeen in this Country, which the People " caught: But the Concluſion of all was, that the " Earth ſunk with three hundred Houſes, and all " the Men, where now appears a large Lake " ſome Fathoms deep. About a Mile from this " Town, was a Lake full of Fiſh, which in theſe " thirty-two Days of the Earthquake, caſt up all " her Fiſh on dry Land, where might have been " gathered many, which had run out of the Water " upon dry Land, and there died: But when the " other great Lake appeared, this former dried up, " and is now become firm Land."

The *ſixth* Kind of Earthquakes, is where Land lying level, ſinks ſuddenly and violently, leaving either a vaſt Chaſm, or a deep Lake in its Place. We have had ſome Inſtances of this within the Compaſs of our own Iſland, particularly in the Neighbourhood of *Winchelſea* in *Kent*; and the Loſs of the Earl of *Goodwin*'s Lands, in that County likewiſe, may be attributed to the ſame Cauſe. There is a very particular Account of an Earthquake of this Nature, in *Stowe*'s Annals, which runs thus.

" On *Wedneſday*, *April* the 6th, 1580, about " Six in the Evening, a ſudden Earthquake happened in *London*, and almoſt generally throughout *England*, which cauſed ſuch amazedneſs of " the People as was wonderful for that Time, and " moved them to make their earneſt Prayers unto " Almighty God. The great Clock-bell in the " Palace at *Weſtminſter*, ſtruck of itſelf againſt the " Hammer, by the Buildings ſhaking; and divers " Clocks and Bells in the City and elſewhere did " the like; the Gentlemen of the *Temple* being at " Supper, ran from the Tables, and out of their " Hall, with their Knives in their Hands; a Piece " of the *Temple* Church fell down, ſome Stones fell " from St. *Paul*'s Church; and at *Chriſt*'s Church, " in the Sermon time, a great Stone fell from the " Top of the Church, which killed on the Spot, " one *Thomas Grey*, Apprentice, and another Stone " alſo bruiſed his Fellow-ſervant, named *Iſabel* " *Everet*, ſo that ſhe lived but four Days after; " ſeveral others were grievouſly hurt with running " out of the Church, and many Chimnies in the " City fell down, the Houſes were ſo ſhaken. This " Earthquake continued in or about *London*, not

" above one Minute of an Hour, and was no more
" felt there; but Eaſtward in *Kent*, and on
" the SeaCoaſt, it was felt three Times, as at *Sand-*
" *wich*, particularly where at ſix of the Clock, the
" Land not only quaked, but the Sea, ſo that the
" Ships tottered."

" At *Dover* alſo, at the ſame Hour, was the like,
" ſo that a Piece of the Cliff fell into the Sea, as
" alſo did a Piece of the Caſtle-wall there; a Piece
" of *Saltwood* Caſtle, in *Kent*, fell down; and in
" the Church of *Hide* the Bells were heard to ſound.
" A Piece of *Sutton* Church in *Kent* fell down, the
" Earthquake being there both heard and felt.
" And in all theſe Places, and others in *Eaſt-Kent*,
" the ſame was felt three Times to move, *to wit*,
" at ſix, at nine, and at eleven of the Clock."

We have alſo two later Inſtances of the ſame Nature, of which the Reader will receive a ſatisfactory Narrative in two private Letters following, written at the very Time the Thing happened.

Deal, *Sept*. 9th. 1692. " Yeſterday the People
" of this Place and Country were under a great
" Conſternation, occaſioned by an Earthquake,
" which began preciſely at two of the Clock in the
" Afternoon, and continued about ſix Minutes,
" during which Time the Houſes ſhook; Pewter,
" Braſs, and other Kitchen Goods, totter'd from
" the Shelves; empty Glaſs Bottles, where they
" lay, daſh'd one againſt another; Beds and
" Tables in the Houſes ſhook ſo much, that Peo-
" ple could not for that Time write; ſome Chim-
" nies fell, and ſeveral Houſes were ſhaken. This
" was at *Canterbury*, *Sandwich*, and many Villages
" thereabouts; tho' not ſo violent, yet we had
" the ſame at *Deal*, particularly at *Deal* Caſtle;
" altho' the Wall be of a vaſt Thickneſs and

“ Strength, yet it ſhook ſo much, that the Inha-
“ bitants thought it would have fallen on their
“ Heads. In *Deal* Town ſeveral Houſes ſhook,
“ and ſo all the Country over ; ſome Houſes ready
“ to tumble down, others ſafe, and felt nothing. In
“ this ſeveral Chimnies fell, and ſome Houſes
“ much injured.”

Portſmouth, *Sept.* 9th. 1692. “ Here fell much
“ Rain yeſterday, and between two and three in
“ the Afternoon this Town and Point for about
“ three Minutes had a very ſenſible Touch of an
“ Earthquake, to the great Terror and Affright-
“ ment of many. The Tower of the Church, with
“ many Houſes, were found to ſhake conſider-
“ ably ; but bleſſed be God I hear not of the leaſt
“ Damage, nor any thing more felt thereof ſince.”

The *ſeventh* Species of Earthquakes conſiſts of ſuch as are leſs known and conſider’d than any of the former, I mean ſuch as are occaſioned by the ſinking of Parts at the Bottom of the Sea, Accidents by which Abyſſes and Whirlpools are occaſioned. That ſuch Earthquakes there are, tho’ from the Place in which they happen, they paſs in a Manner totally without Obſervation ; we may notwithſtanding be fully convinced, if we conſider from how great a Depth theſe kind of Eruptions proceed ; and how little Diſtinction they make between Mountains and Plains, as to the Weight of removing ; for we from hence may eaſily believe that the parts of the Land out of ſight at the Bottom of the Sea are as ſubject to theſe Mutations as the Parts of the Land on Shore and in our Sight. And ſince by the former Relations we have many Inſtances of the raiſing of the Bottom of the Sea, ’tis very probable, that what Quantity of Matter is thrown up and raiſed in one Place, is drawn forth, and becomes thereby the

Cauſe of a Cavity left in another. An Iſland cannot be raiſed in one Place, without leaving ſuch an Abyſs in another. And I do not doubt but there have been as many Earthquakes in the Parts of the Earth under the Ocean, as there have been in the Parts of the dry Land: But being for the moſt Part, till of late, unfrequented by Mankind, and even now but very thinly, 'tis almoſt a thouſand to one, that what happen are never ſeen, and at leaſt a hundred to one, if they have been ſeen, whether they be recorded.

Yet there wants not ſome ſuch kind of Evidence as the Nature of the Fact requires to ſupport it, ſince, that there are great Inequalities in the Depth of the Sea, equivalent to the different Heights on Shore, the Obſervations which Seamen make by the Lead ſufficiently inform us: Inſtead of Hills they find deep Holes, Bottomleſs Pits, and Whirlpools; which laſt may be compared to lofty Mountains, and thoſe Kind of ſpiry Rocks, we uſually call *Pikes*, as that of *Teneriffe*, for Inſtance.

In the Relation we have of Sir *Francis Drake*'s Voyage round the World, we are told that in the Streights of *Magellan*, they, with a plum Line of five hundred Fathoms, felt no Land. In another Place it is ſaid they ſtruck upon a Rock, which was but ſix Feet under Water at Ebb, and yet cloſe by there was no Bottom to be found: We may be ſure this Rock did not grow originally in that Poſition, but that the Sand and Earth formerly adhering to it, were firſt broken by an Earthquake, and then gradually diſlodg'd by the Water.

But to put the Thing out of Doubt, we will mention the Earthquake that happened at *Genoa*, *July* the 2d, 1703. This was ſo inconſiderable as not to be perceived by any but thoſe that were at

Work in the *Mole*, and on board the Gallies; and they without any Storm, or other Circumſtance of Note, perceived the Sea ſink ſix Feet at once, within the Harbour, and the Gallies touched the Ground. It is plain that this muſt have been owing to an Earthquake, that by opening ſome vaſt Gulphs at the Bottom occaſioned this ſudden abſorbing ſo great a Quantity of Water, as muſt have taken ſome new courſe to cauſe an Accident like this.

The Relations we had of this Earthquake mentioned ſome other Particulars worth Notice, tho' they happened not in the Sea, but upon Land. The ſulphurous Water, which is in the Road from *Rome* to *Tivoli*, diminiſhed two Feet and a half in Height, both in the Baſon and in the Ditch. In many Places of the Plain called *Il Teſtino*, there were Springs and Rivulets of Water which formed impaſſible Marſhes, but at this Juncture all dried up. The Water of the Lake called *Inferno*, diminiſh'd alſo three Feet in Height. Inſtead of the old Springs, which ceaſed, there came new ones about a League diſtant from the former, ſo that in all Likelihood thoſe very Currents have changed their Courſe.

One might conjecture from hence, without any Improbability, that theſe Waters had a Communication with the Sea, ſince otherwiſe it is very difficult to apprehend how they came to correſpond ſo exactly with it, not only in their failing, but in their Recovery. However, this being ſomewhat beſide our preſent Purpoſe, we ſhall not dwell upon it any longer, but proceed to another Relation, ſtill more concluſive to our Point, printed by Authority at *Bridgetown*, in *Barbadoes*, and bearing Date *April* the 23d, 1690. " About three Weeks ſince there were felt moſt violent Earthquakes in the *Leeward Iſlands* of *Montſerrat*, *Nevis*, and *Antigua*:

in the two firſt no conſiderable Hurt was done, moſt of their Buildings being of Timber; but where there were Stone Buildings, they were generally thrown down, which fell very hard on the Planters in *Antigua*, moſt of their Houſes, Sugar Mills, and Windmills, being of Stone."

"This Earthquake which affected *Antigua*) was felt in ſome Places of this Iſland, but did no manner of Hurt to Men or Cattle; nor was any loſt in the *Leeward Iſlands*, it happening in the Day-time. It is reported to have been yet more violent in *Martinico*, and other *French* Iſlands. And ſeveral Sloops which came from *Nevis* and *Antigua*, paſſing between *St. Lucia* and *Martinico*, felt it at Sea. The Agitation of the Water being ſo violent, that they thought themſelves on Rocks and Shelves, the Veſſels ſhaking as if they would break in Pieces. And others paſſing by a ſtony, and uninhabited Iſland called *Rotunda*, found the Earthquake ſo violent there, that a great Part of the rocky Iſland ſplit, and tumbled into the Sea, and was there ſunk, making a Noiſe as of many Cannon, and a very great Cloud of Duſt aſcended into the Air at the Fall."

The *eighth* Species of Earthquakes is, where over and above the raiſing and ſinking the Parts of the Earth, there are a great Variety of other Accidents attending; ſuch for Inſtance, as appears in that Relation, which the learned *Cambden* gives us, of a very famous Earthquake in *Herefordſhire*, where in the Year 1571, *Marcley* Hill, in the Eaſt part of the Shire, with a roaring Noiſe, removed itſelf from the Place where it ſtood, and for three Days together travelled from its old Seat.

"It began firſt to take its Journey, *February* 17th, being *Saturday*, at ſix of the Clock at Night, and by ſeven the next Morning, it had gone forty Paces, carrying with it Sheep in their Cotes, Hedge-rows and Trees, whereof ſome were overturned, ſome that ſtood upon the Plain are firmly growing upon the Hill, thoſe that were Eaſt were turned Weſt, and thoſe in the Weſt were ſet in the Eaſt; in this Remove, it overthrew *Kinaſton* Chapel, and turned two Highways near an hundred Yards from their old Paths. The Quantity of Ground thus removed, was about twenty-ſix Acres, which opening itſelf with Rocks and all, bore the Earth before it, for four hundred Yards ſpace, without any ſtay, leaving Paſturage in places of the Tillage, and the Tillage overſpread with Paſturage: Laſtly, overwhelming its lower Parts, it mounted to a Hill of twelve Fathoms high, and there reſted, after three Days Travel."

We have another Relation much to this Purpoſe in *Stowe*, "that on the 13th of *January* 1583, in the Pariſh of *Armitage*, in a Place called *Blackmore* in *Dortſetſhire*, a piece of Ground containing three Acres, removed from the Place where it was planted, and was carried clean over another Cloſe, where Alder and Willow Trees grew, the ſpace of forty Perches, every Perch containing fifteen Foot, and hath ſtopt up a Highway, that directed toward the Market Town of *Cerne*; and yet notwithſtanding the Hedges wherewith it was incloſed, invironed it ſtill, and the Trees ſtand thereon bolt upright, ſaving one Oak that is well nigh twenty Goads, remaineth; the Place where this Ground had its being, is like a great Pit."

Let us conclude what we have to ſay, with reſpect to this Species, by a Relation ſtill more remarkable than the laſt, taken from the *Dutch Haerlem Courant, dated October* the 2d 1699: "Our

“ Letters from *Batavia* in the *Eaſt-Indies*, of the
“ Eighth of *February*, ſay, that on the Fifth of
“ *January*, about two in the Morning, a moſt
“ terrible Earthquake happened, which was ſo violent,
“ that One and twenty brick Houſes, and
“ twenty others were overturned, ſo that if it had
“ laſted a little longer, they muſt have been all
“ thrown down. About forty or fifty Perſons were
“ buried alive, under the Ruins of the Houſes that
“ fell, and near the ſame Number were lamed. Some
“ ſmall time before the Earthquake, the *Blue*
“ Mountain, otherwiſe called Mount *Sales*, burſt
“ with ſuch a terrible Flame and Noiſe, that it was
“ both ſeen and heard there, tho’ ſix Days Journey
“ diſtant. Next Morning, the River which
“ falls into the Sea there, and has its riſe from that
“ Mountain, became very high and muddy, and
“ brought down abundance of Buſhes and Trees
“ half burnt, and the Paſſage being ſtopt, the Water
“ overflowed the Country round, all the Gardens
“ about the Town, and ſome of the Streets,
“ ſo that the Fiſh lay dead in them ; it was a whole
“ Month before the River could be cleanſed, altho’
“ three thouſand Indians were daily employed to
“ clear the ſame, during which time, the People
“ of *Batavia* were obliged to fetch freſh Water
“ from *Bantam*, which is forty Miles. All the
“ Fiſh in the River, except Carp, were killed by
“ the Mud and dirty Water : A great Number of
“ drown’d Buffaloes, Tygers, Rhinocero’s, Deer,
“ Apes, and other wild Beaſts, were brought down
“ by the Current ; and notwithſtanding a Crocodile
“ is amphibious, ſeveral of them were found
“ dead among the reſt.” We might very eaſily
add to theſe a vaſt many other Relations, as for
Inſtance that of the famous Earthquake in *Jamaica*,
but

but we purpoſely avoid mentioning ſuch Events as are commonly known, and cannot fail of occurring to every one's Memory, whenever this Subject is mentioned.

The *ninth* Kind of Earthquakes is, where the Effects produced have been of a milder Nature, ſo that the Shock has been rather attended with Terror, than Miſchief, and ſometimes has been ſo ſlight, as to leave it in ſome meaſure doubtful, whether there happened any Earthquake or not. Of this kind, God be praiſed, have been moſt of thoſe which have happened in this Iſland, within the Compaſs of our Memory; for that they have been heretofore more fatal, the foregoing Relations fully prove. The inquiſitive and indefatigable Dr. *Plot* is of Opinion, that by ſome accidental mixtures of Sulphur and Nitre in the Coal Mines, there is made a true natural Gunpowder, which explodes when it takes Fire, with much greater Force and Noiſe than the artificial; and of this, he gives us two Inſtances in *Staffordſhire.*

"The firſt happened in Chriſtmas time 1677, about Eleven at Night, which came with a Noiſe plainly to be heard; before the Shaking, it was conſiderable about *Willenhall* near *Wolverhampton*, but very ſhort, giving the Earth but one ſhock, and moving as they thought by the Noiſe, from South to North. The ſame Earthquake was felt at *Hanbury*, upon the Confines of *Derbyſhire*; but as Mr. *Villiers* of that Town, a ſober grave Gentleman, aſſured me, it happened there about Eight in the Evening, which argues its Motion muſt be from Eaſt to Weſt, and very ſlow, or elſe not the ſame Earthquake; neither whereof can certainly be concluded; for that nobody knows in what Meanders the Caverns of the Earth run, nor with what Obſtacles it might meet by the way, to retard and prolong the Time of its Motion."

" *November* the fourth 1678, there happened another Earthquake in this County, it was moſt dreadful of any I could hear of about *Erewood*, whither it came with a Noiſe not like a Clap, but a flat rumbling diſtant Thunder, yet ſo great that it wakened People in their Beds, at Eleven a Clock in the Night, about which time it begun, and continued till towards Two in the Morning; the Earth moving very ſenſibly three Times, at about half an Hour's diſtance each Motion from the other. The Night following there happened another, but not ſo great; yet not without Noiſe, as I ſuppoſe very few do, if any, it muſt be where the Fire-damps, kindle ſo deep in the Earth, that the Exploſion cannot be heard through ſo denſe a Body, as it may be thence to the Superficies, tho' the Convulſion may be ſenſible notwithſtanding.

" That which was felt at *Oxon*, about ſeven in the Morning, *September* the ſeventeenth 1683, was alſo accompanied with a Noiſe like diſtant Thunder, the murmuring Sound preceding the Shock, about two Seconds of time. *October* the ninth, in the ſame Year, about Eleven at Night, there happened another in *Staffordſhire*, and all the adjoining Counties, which as I have it from good Hands, was not without a Noiſe neither; whence I conclude, that few or none happen without, and that all of them have their Origin from the kindling and Exploſion of Fire-damps."

In a Letter from the Reverend Mr. *Paſcall*, to to the moſt ingenious Dr. *Hooke*, we have a very clear and preciſe Account of ſuch an Earthquake, which happened at *Chedſey* in *Somerſetſhire*, dated *January* the fourth 1680, in theſe Words: " *Worthy*

thy Sir, Yeſterday about ſeven in the Morning, I being about to riſe took Notice of what ſeemed a ſmart Guſt of Wind, which was followed with a Jog of our Houſe, and that immediately with a very ſenſible Shaking of the Houſe, and particularly the Bed in which I lay. I doubted the Fall of ſome large Piece of Timber or Stone-work, and cauſed the Servants to make diligent Search all about for the Cauſe of it, tho' not without ſuſpicion, that it might be an Earthquake. Before Night I become fully ſatisfied that it was ſo, for my Neighbours, many obſerved the like in their Houſes, tho' no hurt was done. This Day I hear that it was in other Pariſhes, one within a Mile of me, lying in the ſame Level; another above four Miles from me, lying on the further ſide of an Hill, and which is a firm Rock. This Afternoon comes a Letter from an Acquaintance of mine in *Bridgewater*, two Miles from me, and on the other ſide of their navigable River, which ſays thus.

"I ſuppoſe you heard of the Earthquake which "happened with us this Morning about Seven "o'Clock. It ſhook our ſtrong Stone Houſe ſo, "that I began to look whether the Walls were not "ſcattered or craſed with a Noiſe as if ſome very "great thing had fallen upon the Ground. One "or two in *Eſtover*, a Part of that Town, on our "ſide the River, were ready to leap out of Bed "upon it, *&c.*" The Air was very calm, as being a froſty Morning upon the Snow lying, which fell the Day before. It laſted but a very ſhort Time. I do not remember for theſe eighteen Years of my Abode here, to have known any ſuch thing; but I call to mind the Obſervation of *Acoſta* and others, that they do moſt commonly happen in Places near the Sea, and ſuch is our Country, of which I meet many Arguments which perſuade me that it was in theſe Parts of it formerly gained from the Sea."

To theſe I ſhall add another ſhort Relation, written by the ingenious and accurate M. *de la Hire*, and which is inſerted in the Philoſophical Memoirs of the Royal Academy of Sciences at *Paris*; his Words are theſe,—" *October* the 6th, 1711, at 8 " in the Evening, an Earthquake was perceived " only in my Apartment at the Obſervatory; and " one of the principal Signs of it was, that the " great Rings of a Copper Ciſtern, made a good " deal of Noiſe, and continued a long time in " Motion, which was obſerved by all who were in " the Place; but I did not mention it then, be- " cauſe I ſuſpected that this Ciſtern, which had a " good deal of Water in it, might have ſlipped a " little upon its Frame; and that a ſmall Motion " of the Water might have given one to the Ciſ- " tern, ſufficient to make the Rings ſtrike againſt " the Body. But ſome Days afterwards we re- " ceived Letters out of the Country, thirty Leagues " from *Paris*, by which we have been informed of " an Earthquake which was felt there, and had ter- " rified the People of the Place; and it was on the " ſame Day, and at the ſame Hour, that we per- " ceived it at the Obſervatory. We have had Ac- " counts of it alſo from other Places, where it " was very conſiderable."

In the ſame Paper he enlarges very much upon theſe Matters, and chiefly on the Earthquake that was felt at *Baſil*, of which Mr. *Bernoulli* had ſent him a very exact Relation, and this is the Reſult of it. " There were two Shocks of this Earthquake at but a little Diſtance from each other, *February* the 9th, between four and five in the Morning. We felt one at *Paris*, *October* the 6th, at eight in the Evening; whence we ſee, that the Cauſes of theſe Earthquakes were very diſtant. At *Baſil* the Earthquake was preceded by a very violent South Wind, like a Tempeſt or Hurricane, which was accompanied by an extraordinary Heat in this Seaſon of the Year, tho' it was very cold before. At that Time all the Snow, which was very deep upon the Ground, was melted in leſs than two Hours, and all the Rivers, and the *Rhine* itſelf, increaſed extraordinarily, which had not been ſeen till then; but when this Wind ceaſed, the Cold began again, and there fell a very great Quantity of Snow, to the Height of two Cubits. Theſe are his own Words. Mr. *Scheuchzer* obſerves, that the ſame Accidents of Wind and Heat were alſo obſerved at *Zurich*; but he does not ſay the Earthquake was felt there; he only adds, that at the ſame Time he obſerved the Height of the Barometer to be twenty-five Inches, eleven Lines. In the laſt Place, he relates, that the Fruits of the Earth did not ripen well in his Neighbourhood."

To theſe we might add another Species of *imperceptible Earthquakes*, for no doubt there may happen, and indeed there certainly does happen, great Convulſions in the Bowels of the Earth, that occaſion conſiderable Alterations in the ſuperincumbent Parts, of which, however, we who live upon them, have no Notice at all, till long afterwards, when in conſequence of the Mouldering and Decay, cauſed, if I may be allowed the Expreſſion, by ſuch ſilent Earthquakes, great Rocks, or very large Pieces from the Sides of Hills, are detached and tumbled down without any viſible Effect of an Earthquake at the immediate Time of their falling. It might be probably ſomething of this Kind that produced the Accident which happened ſome Years ago at

Scarborough Spaw; and after the ſame Manner we may account, with great Probability, at leaſt, for a Multitude of Events which are very aſtoniſhing to the Generality of Mankind.

In reaſoning about Earthquakes, we muſt always remember, that the Vapours by which they are cauſed, are lodged very deep in the Earth, and paſs through Caverns of which we have no Notice, and with which it is impoſſible we ſhould have any Communication. That this is a Matter of Fact, and not a mere Conjecture, hazarded without Proof, will appear from ſeveral of the foregoing Relations, in which Accounts are given of the vaſt Depths of thoſe new Lakes produced by Earthquakes, which beyond all Contradiction ſhew, that the Vaults forced open by the Exploſion of nitro-ſulphureos Vapours, are of almoſt inconceivable *Capacity*, ſince they not only receive in ſome Caſes great Mountains, with every Thing that either grows or is conſtructed upon them, but bury them quite beyond our reach.

We may alſo perceive, that theſe ſubterraneous Paſſages communicate with each other, to a prodigious Extent, as is evident from the laſt Narrative, which renders it highly probable, that the ſame Vapours produced an Earthquake at *Baſil* in *Switzerland*, and ſome Months after, a fainter Succuſſion in the Neighbourhood of *Paris*, and even beyond it. But then this happened upon the Continent, and perhaps there is no arguing in the ſame Manner with Reſpect to Iſlands, that are at any conſiderable Diſtance from the Continent.

I ſay *perhaps*, and alſo add the Word *conſiderable*, becauſe tho' many judicious Perſons thought the contrary, yet there is inconteſtible Evidence to prove ſuch a Communication between the ſubterraneous Caverns in *Italy* and *Sicily*. It is an old, and for any thing we know to the contrary, may be a true Notion, that this very Iſland, upon which we live, was ſeparated by an Earthquake from *France*, and it is with ſtill greater Probability preſumed, that the Iſlands of *Scilly* were produced in the like Manner.

That this is very far from being impoſſible will appear to any Man, who conſiders that the *Chineſe* have a certain Record of the ſinking of a vaſt Tract of Country, the Sea covering which, is now ſtiled the Gulph of *Corea*, and ſeparates the *Peninſula* of that Name, from the Empire of *China*. We know too, that there are Abundance of judicious Naturaliſts who believe that the *Marianne* Iſlands, and thoſe ſtiled the *New Phillipines*, which lie in the vaſt Ocean, between *Aſia* and *America*, were produced in the ſame Manner, which if true, would be a ſtrong Argument in Favour of ſome Continent lying to the Northward of thoſe Iſlands not yet diſcovered, and to which ſo many Attempts have been made to find a ſhort Paſſage by the North-eaſt, and the North-weſt.

But now having ſaid ſo much of innocent, imperceptible and incertain Earthquakes, it ſeems to be high Time to come to that, which we have ſo lately felt, and which gave Occaſion to this Diſcourſe. As yet, we have had no diſtinct Accounts, and indeed we have not had Time to receive any, of the Extent or Direction of this Paroxiſm, but we might certainly have expected a more clear and circumſtantial Relation, than any which have hitherto appeared of the Manner in which it was felt in *London*; and therefore having attended to it, with peculiar Care at the Time, I ſhall endeavour to ſet down, as plainly and as exactly as I can, what was obſerved in my own Houſe.

On *Thurſday*, *February* the 8th, 1749-50, at thirty Minutes after Twelve, four or five Perſons in the lower Part of the Houſe, felt it ſhake very perceptibly, and at the ſame Time heard a Noiſe ſo loud, that it was taken for the Motion of a Deſk upon Caſtors in a Room over-head. A Servant-maid in the Dining-room being upon her Knees, ſcowering the Hearth, felt the Marble Slab riſe under her. In the two Pair of Stairs, a Perſon writing at a Deſk, felt a Table riſe under his Arm, firſt on one Side, and immediately after on the other. Another Perſon in the ſame Room taking a Book out of a Shelf, obſerved the Books over it to be ſhaken, and heard ſo great a Noiſe, as to occaſion his calling inſtantly, to know what they were doing in the Garret. A Maid who was there, ſaid it was the Door ſhut by the Wind, which Door, tho' it goes very hard, was indeed ſhut with as much Force as if it had been done by a Perſon without, and yet there was nobody beſide on that Floor.

The Weather had been rainy and cloſe for ſome Days, there had been a thick Fog that Morning, and at the Time of the Shock the Air was very remarkably hazy and warm, and continued ſo all the Afternoon and Evening, inſomuch, that I ſeveral Times tried, by dropping a Bit of Paper out of a two Pair of Stairs Window, to diſcover whether there was any Breath of Air ſtirring, but the Pieces of Paper fell directly to the Ground, in the ſame manner they would have done in an exhauſted Receiver, except that the Motion was ſomewhat ſlower. Between nine and ten of the Clock at Night, the Weather was ſo ſtill, that the Flame of a Candle held in the open Yard, was not perceived to be affected by the Air; all which Circumſtances agree perfectly with the Deſcription of Earthquakes in other Places.

If we enquire into the Cauſe of this Earthquake, perhaps it will be no improbable Account of it to ſay, that the Winter being remarkably dry till within a few Days before, the Rain which then fell might penetrate very deep into the Earth; and if in any of the Commons, Heaths, or barren Grounds, not far diſtant from this Capital, there be, as it is reported there are, Coals in the Earth; theſe, if they are of a ſulphureous kind, might, through their becoming wet in this manner, emit a Vapour capable of producing ſuch a Shock as that which was felt.

To ſhew that this is not a ſudden Conjecture excited by the Circumſtances obſerved upon this Occaſion, I will here cite the Obſervation of the ingenious Dr. *Childrey* to this very Purpoſe: "I conceive, "ſays he, that after great Wets the ſtrong Tendency of the Waters downward altogether preſſeth in the Air, in the Vault on all Sides, and "ſo begets a Conflict between the Water and the "Air, the Air ſtruggling outragiouſly to free itſelf, "which Conflict occaſions a Confuſion; and this "Confuſion muſt needs looſen the incumbent Earth, "and ſo contribute alſo to its falling in, if it be "looſe and ſandy; and I am of Opinion, that "whenſoever the Truth comes to be found out, it "will appear that this tumultuary Tendency of "Waters downward (after great Wets) preſſing in "the Air in hollow Places of the Earth, begets a "Conflict; and that a Concuſſion, which is what "we call an Earthquake; ſo true it is that Earthquakes always ſucceed great Wets, or a ſudden

" Glut and Tempeſt of Rain in the Time of a great
" Drought."

To this we may add what the induſtrious and indefatigable Dr. *Plot* tells us, in his Hiſtory of *Staffordſhire*, from the Authority of the worſhipfrl *Dudley Dudley*, Eſq; that Small-coal with Sleck thrown moiſt together will fire, by reaſon of its Sulphureouſneſs; " which, ſays he, I am inclined to be-
" lieve, ſince I find amongſt Dr. *Powers*'s Obſer-
" vations, that the *Pyrites aureus* being expoſed to
" the moiſt Air, or ſprinkled with Water, will
" ſmoak, and grow exceeding hot; and if many
" be laid in a Heap and watered, will turn red hot
" of themſelves, as he ſays he had ſeen them him-
" ſelf, whereof he acquaints us with a very unhappy
" Example that fell out at *Ealand*, a neighbouring
" Town to him in *Yorkſhire*, where one *Wilſon*
" having piled up many Cart Loads of them in a
" Barn of his, the Roof being faulty, and admit-
" ting Rain Water to fall in copiouſly amongſt them,
" they began to ſmoak, and at laſt to take fire,
" and burn like red-hot Coals, ſo that the Town
" was in an Uproar about the quenching of them."

It would be no difficult Taſk to aſſemble other Paſſages from Writers of great Reputation to this Purpoſe; but I would not willingly either tire the Reader's Patience, or ſuggeſt any thing to the Prejudice of further Enquiries. This only I will take leave to ſay, that after dry Weather, more eſpecially in Winter, when hard ſoaking Rains follow for ſeveral Days together, they will be generally found to produce very thick Fogs, and ſuch copious Steams of ſulphurous Vapours from the Earth, as generate Lightning, ſometimes with, and ſometimes without Thunder. Whenever therefore this Kind of Weather is not attended with ſuch Conſequences, there is certainly ſome ground for preſuming the Cauſe of this to be the Vapour not finding a free Paſſage through the Earth, at leaſt in Proportion to its Quantity; and therefore not ariſing into the Air, but forcing a Paſſage through ſubterraneous Caverns, it is very conſonant to Reaſon, that it may have the Conſequence before mentioned.

As to the Effects of Earthquakes upon the Air, we find many things reported in Books, upon which, however, too much Weight ought not to be laid, becauſe, without doubt, theſe Effects will vary according to the Climates in which the Earthquakes happen; and as to theſe which we have lately felt, the briſk Winds that have ſince followed, may be well ſuppoſed to have bruſhed and purified the Air from whatever noxious Particles the Earth might expire. Neither ought this Obſervation to diſpleaſe thoſe who take a Pleaſure in moralizing on that Event, ſince to Men of a religious and generous Frame of Mind, a Senſe of the Divine Goodneſs and Mercy in preſerving us from thoſe Calamities that commonly attend the Shock of an Earthquake in other Countries, will be as ſtrong a Motive to ſerious Thoughts and honeſt Purpoſes, as the Terror that might be impreſſed by ſetting ſuch a Mark of the Inſtability of the Globe upon which we dwell in the fulleſt Light poſſible, and will probably laſt much longer. For *Fear* is a ſlaviſh Paſſion that ceaſes almoſt as ſoon as the *Rod* is withdrawn; while *Gratitude* is a noble Warmth that glows in every rational Mind from the *Recollection* of *Benefits* received; and therefore cannot be extinguiſhed while we enjoy our *Exiſtence.*

To the Author of The Diſſertation upon Earthquakes.

S I R,

IT is generally confeſſed, amongſt the intelligent and inquiſitive Part of the World, that conſidering the ſhort Space of Time you took to compoſe and publiſh your Diſſertation upon Earthquakes, it is very ſolid and inſtructive, as well as curious and entertaining. You have therein given us a general Idea of the Cauſes and Operations of Earthquakes, ſupported by Reaſon as well as Authority; and the Method you have taken, of diſtinguiſhing them into Claſſes, is certainly very juſt and proper, and I preſume muſt have been that of your Common-Place-Book, from whence the Materials of this Work were drawn; and ſuppoſing it ſo to be, I think you have given the Publick a very agreeable Inſtance of your Diligence, in digeſting a great deal of philoſophical Reading; which is the true Reaſon of my giving you this Trouble, which, from the free Spirit you have ſhewn, I flatter myſelf will not give you any Offence.

But permit me, Sir, to ſay, that how compleat ſoever your Diſſertation may be, upon that Plan which you have formed, there are ſtill many Things in relation to this copious Subject, that are either not touched, or but ſlightly touched, in that Performance; tho' I think it muſt be allowed you, that there is nothing foreign to the Subject, or which a candid Reader could have wiſhed you had left out. You might very poſſibly have given us full Satiſfaction, if you had not ſtudied ſo much to be conciſe, and to bring your Obſervations within ſo narrow a Compaſs. This is not barely my Opinion, but that of many of your Readers, whoſe Thoughts upon this Matter I have taken ſome Pains to collect; and believe it will not be diſpleaſing, either to them or to you, that I venture to repreſent them as worthy of your further Conſideration, in caſe you have either Leiſure or Inclination once more to exercife your Pen.

The Obſervation made at the Beginning of your Diſcourſe, that the different Curioſities of Men are fixed for a Time by any rare and extraordinary Event, is equally juſt and judicious, and the Uſe you have made of it truly laudable; for you have certainly led Numbers into a Courſe of Thinking and Reaſoning, to which otherwiſe perhaps they might never have inclined. This being the Caſe, they have methinks ſome Right to expect, that you ſhould not overlook the Fruits of that Spirit which you have raiſed; and therefore give me Leave to ſuggeſt to your Meditations the following Queries, which if you anſwer with the ſame Sagacity and Spirit ſhewn in your firſt Diſſertation, will convince us, that little, if any thing, has eſcaped you, in reference to a Subject of great Importance in itſelf, and to which more People are attentive at preſent then you can well conceive. The Queries are theſe:

I. What were the Notions of the moſt diſtinguiſhed Philoſophers amongſt the Antients concerning Earthquakes? How far have they been diſproved or confirmed by the Moderns? and, Whence does it appear, that we underſtand this Subject better or more clearly than they did?

II. What convincing Arguments can there be brought to prove, that there are ſuch vaſt Caverns, and ſuch continued Stores of combuſtible Matter, in the Bowels of this Globe, which we inhabit, as there muſt be, if the Cauſes commonly aſſigned for Earthquakes be true?

III. What Proofs are there, that it is poſſible for combuſtible Matter to act with ſuch amazing Force, at ſuch prodigious Diſtances, and with ſuch a Variety of Directions, as inconteſtible Hiſtories of Earthquakes demonſtrate to us they have done?

IV. What occaſions that Noiſe in the Air, or over head, with which Earthquakes are commonly attended? or, What Inſtances are there of what may be ſtiled ſilent Earthquakes, where the Tremor is attended with no Noiſe at all?

V. What gave riſe to the Opinion that prevailed among the Antients, and ſtill prevails in ſome Places, that Earthquakes may be foretold? Is there any Truth in this? And, if there be, what are thoſe Indications?

VI. What Ground is there for eſteeming ſuch Concuſſions of the Earth ominous?

VII. What Foundation is there for believing that Earthquakes are followed by Plagues or epidemic Diſeaſes?

VIII. What Connection can there be between the unuſual Lights in the Sky and ſuch Commotions in the Earth? Has there any ſuch Connection been obſerved in other Countries? or, Is this to be conſidered as a Vulgar Error, or as a Philoſophical Amuſement?

IX. What, the foregoing Points being duly conſidered, are the Conſequences, that, without any Tincture of Levity, Credulity, or Superſtition, may be apprehended from that Earthquake, which was ſo lately and ſo ſenſibly felt in this Capital.

I am, Sir,

Your obedient humble Servant.

BIBLIOTHECA BODLEIANA

FINIS.